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# SHORT COMMUNICATIONS

**Breeding biology of Muscovy Ducks using nest boxes in Mexico.**—The Muscovy Duck (*Cairina moschata*) is a cavity-nesting species widely distributed in the neotropics, ranging throughout much of Mexico and Central and South America (Johnsgard 1978). Despite its extensive range, however, the Muscovy Duck is among the least studied of all New World waterfowl. Most information is historical and sparse (Phillips 1922, Delacour 1959, Leopold 1959, Wetmore 1965), and even recent literature discusses the species only in general terms (Johnsgard 1978, Bolen 1983).

The Muscovy Duck has disappeared or declined throughout much of Mexico, presumably because of year-round hunting and extensive agricultural clearing of its riparian habitat (Leopold 1959, Saunders and Saunders 1981). This decline prompted Woodyard and Bolen (1984) to study selected aspects of Muscovy Duck ecology during 1980 and 1981. Their investigation was the first direct effort to examine nesting biology of the Muscovy Duck, and was the first time nest boxes designed specifically for the Muscovy Duck were erected in Mexico (1981). Only 18 boxes were erected, of which four were used by Muscovy Ducks; however, the study confirmed that nest boxes were a viable tool for managing populations of Muscovy Ducks.

Since 1981, over 4000 nest boxes have been placed in Mexico by Ducks Unlimited of Mexico, A.C. (DUMAC), but no systematic effort has been made to gather additional data on nest-box use or nesting biology of the Muscovy Duck. The objectives of this study were to document basic aspects of the nesting biology of Muscovy Ducks using the DUMAC boxes and to provide baseline information for future research and conservation efforts.

*Study area and methods.*—Initial box searches were conducted at nine sites in the state of Tamaulipas, Mexico, and involved checking >700 boxes. Subsequent box checks then were confined to three localities where Muscovy Duck nests were found. The northernmost location was at Laguna la Nacha, which is a 4000-ha freshwater lake 30 km east of San Fernando, Tamaulipas, and 110 km south of Brownsville, Texas (Fig. 1). The surrounding area has been described as mesquite scrub (Leopold 1950), where irrigated agriculture is the predominant land use pattern, and sorghum is the principal crop. Many temporary and permanent lagoons and other wetlands (the Tamaulipas Lagoons) are located nearby, and the Laguna Madre and Gulf of Mexico are 10 km to the east. A total of 168 nest boxes was available on three islands in Laguna la Nacha. These islands ranged in size from <4.3–15.8 ha and were located 450–750 m from shore. A total of 126 boxes were available during the 1985 and 1986 nesting seasons; 42 additional boxes were added prior to the 1987 season. All boxes were placed on metal or wood poles, but none was protected with predator guards. Woodyard and Bolen (1984) describe the basic design of the nest boxes used by Muscovy Ducks during this study.

The second study site was located about 120 km south of Laguna la Nacha on the Coltrisa and Palmas ranches, approximately 15 km southeast of Soto la Marina, Tamaulipas (Fig. 1). The general physiography and vegetation of this area were described by Ojeda and Medrano (1977). The primary land use on the ranches was cattle grazing and hay production. There were 135 boxes available on the Coltrisa Ranch, all in or near a 5–10 ha shallow (<3 m) lagoon. Boxes were located on flooded dead trees, living acacia (*Acacia* spp.) and mesquite (*Prosopis* spp.) trees and on wooden poles along the shore; boxes on wood poles were protected with predator guards. There were 69 boxes on the Palmas Ranch. Ten boxes were located in trees along the banks of a heavily wooded arroyo, and another 10 were placed on similar habitat along the Palmas River. Eleven boxes were located on wooden poles

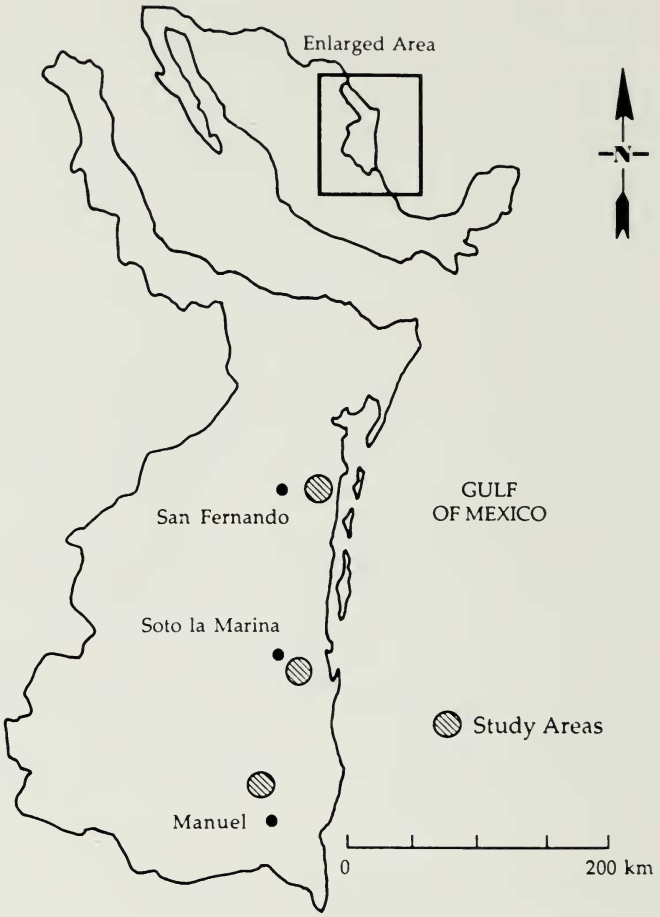


FIG. 1. Location of Muscovy Duck nest-box study areas in Tamaulipas, Mexico.

around a <1-ha farm pond, whereas the remaining 38 boxes were attached to dead trees around a 2-ha pond. Only those boxes on wooden poles were protected with predator guards. Boxes on both ranches were first available during the 1987 nesting season.

The southernmost area was located 100 km south of the Coltrisa and Palmas ranches on the Santa Florinda ranch, about 15 km northeast of Manuel (Fig. 1). This region also was described by Ojeda and Medrano (1977); the primary land use was cattle ranching. A total of 35 boxes was located on metal or wooden poles in or around four 1–2-ha farm ponds. Again, only boxes on wooden poles were protected with predator guards. Twenty of the 35 boxes had been available during the 1985 and 1986 nesting seasons.

Nest boxes were checked at 1–2 week intervals from 1 April–8 August 1987, but road and weather conditions occasionally precluded box checks for up to four weeks. Data recorded at each nest were number of eggs, egg length and diameter (calipers, nearest 0.05

mm), and weight (Homs spring scale, nearest 0.5 g). Date of nest initiation was calculated by backdating, assuming a laying rate of one egg/day (Sowls 1955). Dump nests (i.e., nests containing eggs from >1 female) were identified as having a laying rate of >1/day and/or an exceptional final clutch size (in one instance, 21 eggs). Incubation was assumed to begin on the day following clutch completion and hatching date was determined by actual observation of ducklings in the box. A nest was considered successful when ≥1 egg(s) hatched. Data recorded for each nest box were general habitat type, overhead canopy cover, box condition, box height, orientation of box entrance, and distance to water.

Two Muscovy Duck females initially were captured and banded at the nest box after two weeks of incubation as recommended by Grice and Rogers (1965) for Wood Ducks (*Aix sponsa*); however, banding was discontinued because both females deserted the nest. A third Muscovy Duck female was banded when captured on a nest with ducklings. Overall, 29 ducklings were web-tagged to provide birds of known age and origin for future studies.

*Results and discussion.*—Thirteen (3.2%) of 407 nest boxes checked at the three study areas were used by Muscovy Ducks. The highest box use occurred at Santa Florinda (9 of 35, 25.7%). Box use at other sites was <1% with only three of 204 and one of 168 boxes used at the Coltrisa/Palmas and Laguna la Nacha sites, respectively. However, box use by Muscovy Ducks at Laguna la Nacha had been 8.3 and 11.3% during the 1985 and 1986 nesting seasons, respectively, although all boxes were not checked in 1986 (DUMAC unpubl. data). Nest boxes appeared to be the only suitable nest sites in the area (i.e., few natural cavities were observed), thus the decline in nesting at Laguna la Nacha suggests that Muscovy Ducks are not as philopatric as are other cavity-nesting waterfowl (Bellrose 1980) or that illegal shooting had occurred in the area (Muscovy Ducks are protected in Mexico). Regardless, 1987 results from Santa Florinda and 1985–86 results at Laguna la Nacha demonstrate that nest boxes are acceptable to Muscovy Ducks.

We did not systematically assess the availability of natural cavities in the area of nest boxes, but large trees were sparse. Thus, the low incidence of box use suggests that populations of the Muscovy Ducks in this area of Mexico are low, and thus boxes are underutilized. Therefore, it may be more beneficial for management of Muscovy Ducks to place fewer boxes at more locations rather than concentrate large numbers of boxes on a given site. Additional boxes could then be added if the nesting population increases.

The first nest was initiated on or before 24 April 1987 and the last on 24 July 1987. The frequency of nest starts remained constant during this time and showed no discernable peak. For example, of the 12 nest initiations, one occurred/week (N = 7) from 3 May through 21 June, excepting two nests initiated during the week of 10 May. Only four nests were visited more than once during laying, but verified a laying rate of one egg/day as was assumed in calculating initiation dates. The first hatch occurred on 6 June and the last on 6 September. Woodyard and Bolen (1984) reported July and August hatching dates for two Muscovy Duck nests in Veracruz, Mexico.

Nesting phenology data were complete for 7 of 10 successful nests and indicated an average incubation period of 30 days (range = 30–31 days). This contradicts the generally accepted incubation period of 35 days as determined from captive or domestic birds (Delacour 1959, Bolen 1983).

Overall, the 1987 nesting season for the Muscovy Duck (first initiation to last hatch) in Tamaulipas lasted about 135 days (24 April–6 September). Leopold (1959) reported a few cases of nesting during June and July in Mexico and evidence of one female nesting in October, whereas Wetmore (1965) considered the nesting season in Panama to be June. In contrast, Phillips (1922) cites records of Muscovy Ducks nesting in South America during December, February, and May. Johnsgard (1978) has suggested a correlation between nesting and the rainy season. Long-term records on time of nesting are needed to determine if any

such relationship exists and to accurately establish the nesting season of the Muscovy Duck throughout its range.

Egg length and diameter were measured for 110 Muscovy Duck eggs from 10 nests. These measurements averaged 61.25 ± 0.17 [SE] × 44.55 ± 0.12 mm, which were smaller than the 67 × 44 mm average reported from Mexico by Leopold (1959). However, the range in egg measurements was 55.5–65.5 × 41.7–46.9 mm, which was similar to the 56.5–67.5 × 42.7–48.0 mm range found in Panama by Wetmore (1965).

Weight was measured for 31 eggs from four nests and averaged 66.4 g ± 0.71 SE (range 58.0–75.0 g). Comparable weights of wild Muscovy Duck eggs have not been reported. Eggs were glossy white in color, although some had a slight green or buff sheen.

Average clutch size of all nests was 13.6 ± 3.7 [SE] eggs/nests (N = 13) with a range of 9–21 eggs. Normal (i.e., not dump nests) Muscovy Duck nests had 9–15 eggs ($\bar{x}$ = 12.6 ± 1.9; N = 9). This is somewhat higher than the average 8–10 eggs/nest reported previously (Leopold 1959, Wetmore 1965); however, no sample size was presented by these authors. Woodyard and Bolen (1984) recorded nine eggs in the 2 normal nests of the Muscovy Ducks they observed in Mexico.

Four (31%) nests were classified as dump nests. Although dump nesting by Muscovy Ducks was presumed to occur (Phillips 1922, Wetmore 1965), it had not been documented. Average clutch size of dump nests was 17.7 ± 3.2 eggs/nest (N = 4) and ranged from 15–21 eggs. Two dump nests contained two Black-bellied Whistling Duck (*Dendrocygna autumnalis*) eggs each; a third nest with a normal clutch of Muscovy Duck eggs also contained two Black-bellied Whistling Duck eggs. Two of four Muscovy Duck nests observed by Woodyard and Bolen (1984) also contained mixed clutches, one of which was incubated successfully by a Muscovy Duck. In this study, all the mixed clutches were incubated by a Muscovy Duck female.

Ten of 13 (77%) Muscovy Duck nests were successful, which was similar to the 75% nest success observed by Woodyard and Bolen (1984) for four Muscovy Duck nests in boxes in Veracruz. McCamant and Bolen (1979) found that average nest success for Black-bellied Whistling Ducks nesting in boxes over a 12-year period also was 75%. Bellrose (1980) summarized the results of 22 Wood Duck nest box studies and found that nest success ranged from 32–95% but was typically between 65–75%.

Of the three (23%) Muscovy Duck nests that failed to hatch during this study, two were deserted during incubation, presumably because of observer disburbance; a third nest was deserted when the box was flooded. Three of four dump nests were successful; the one nest failure was caused by observer disturbance. Among mixed clutches, two of three nests incubated successfully by a Muscovy Duck female and one Black-bellied Whistling Duck egg was hatched within each clutch. In one case, the Black-bellied Whistling Duck egg hatched at least one day before the Muscovy Duck eggs, but all ducklings left the box. The incubation period of Black-bellied Whistling Duck eggs is 25–30 days (Bellrose 1980). Thus, regardless of which species incubates a mixed clutch there is potential for Muscovy Duck eggs not to come to full term or for Muscovy Duck ducklings to remain in the box.

During this study one of two marked females that deserted nests subsequently was observed to incubate successfully a second clutch. Renesting is common among many waterfowl species, and although presumed to occur among Muscovy Ducks, it had not been verified previously.

A total of 177 muscovy eggs were laid, of which 96 (54%) hatched. Of these, 142 eggs were laid in successfully incubated nests from which 97 (68%) hatched (Table 1). Hatchability of eggs from normal nests was greater than dump nests (73 vs 59%) because many eggs were added to dump nests after the onset of incubation, and thus did not come to full term before

TABLE 1
HATCHABILITY OF EGGS FROM SUCCESSFUL MUSCOVY DUCK NESTS IN TAMAULIPAS, MEXICO, 1987

| Nest type | No. nests | No. eggs | % hatch | Average no. ducklings/nest |
|---|---|---|---|---|
| Normal | 7 | 86 | 73 | 9.0 |
| Dump | 3 | 56 | 59 | 11.0 |
| Combined | 10 | 142 | 68 | 9.6 |

other eggs hatched. Woodyard and Bolen (1984) observed three successful Muscovy Duck nests and found hatching success to be 88%. McCamant and Bolen (1979) found 63% hatching success among successful Black-bellied Whistling Duck nests and also concluded that dump nesting was responsible for reduced hatching success. Clawson et al. (1979) reported similar findings for Wood Ducks (77% for normal nests; 63% for dump nests).

There were 96 Muscovy Duck and three Black-bellied Whistling Duck ducklings produced from the 10 successful Muscovy Duck nests. Dump nests produced a slightly higher number of ducklings/nest (11.0, N = 3) than did normal nests (9.0, N = 7) (Table 1). However, the impact of dump nesting on productivity of cavity-nesting waterfowl is debatable (Clawson et al. 1979, Jones and Leopold 1967) and will require further study in the Muscovy Duck.

The small number of boxes used by Muscovy Duck females, their wide distribution, and the lack of variability among box and habitat characteristics at specific study areas did not allow for meaningful tests of nest-site preference. However, some general observations of nest-box selection were made.

Muscovy Duck females used boxes in a variety of habitat types. There were nine nests in small farm ponds (<2 ha), two in flooded dead timber, one along a heavily wooded creek, and one on a flooded island in Laguna la Nacha. Canopy cover at used boxes varied from 0–75%, but 10 of 13 (87%) had no overhead cover. However, 9 of these nests were at Santa Florinda where all 35 boxes were located in open habitat. Wooded streams traditionally have been regarded as Muscovy Duck habitat, but it appears that they will use many habitat types provided a suitable cavity is present. The same flexibility in nest-box selection has been demonstrated for the Wood Duck (Grice and Rogers 1965).

Box condition was classified subjectively as good (little evidence of deterioration), fair, and poor (showing major cracks and holes), but condition did not appear to influence box use. Height of used boxes varied from 0.8–3.5 m, which covered the range of available box heights. Nine nests were found in boxes facing southeast (85–175°) and three in boxes facing southwest (220–230°); only one used box faced north. Distance to water also may have influenced nest box use as 11 (85%) nests were found in boxes directly over water. The remaining nests were in boxes within 3 m of water, however, most available boxes were within 5 m of water.

Overall, this study demonstrates that nest boxes can be an effective tool for the conservation of the Muscovy Duck and also can provide a practical research tool allowing for study of this secretive species. More research is needed to increase the sample size of Muscovy Duck nests, particularly to examine the role of dump nesting and mixed-species clutches on Muscovy Duck productivity. Effectiveness of the nest box program and status of Muscovy Duck populations also is in need of continued monitoring.

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**Bald Eagle use of a communal roost.**—In many areas where Bald Eagles (*Haliaeetus leucocephalus*) concentrate at seasonal food sources, they forage and roost at separate sites (Isaacs and Anthony 1987, Keister et al. 1987). Migrating Bald Eagles have congregated in Glacier National Park, Montana, each autumn since 1939 to feed on non-native kokanee salmon (*Oncorhynchus nerka*) spawning in the 4-km stretch of lower McDonald Creek. Peak censuses of Bald Eagles have ranged as high as 639 in 1981 (McClelland et al. 1982). Eagles